# Carbohydrate Recognition Domains (CRDs)

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Mannose Binding Protein in Innate Immunity

Classical pathway

Antibodies → C1q-C1r-C1s → C4-C2 → C3 → C3a + C3b

Lectin pathway

MBP-MASP → C3a + C3b → C5-C9 → Cell lysis

Opsonization (phagocytosis)

MBP dimer of trimers

C-type CRDs

Protease domain

Sushi-CUB-EGF domains

Gly37→Glu

Gly34→Asp

Collagen tails
Surface Glycans from Pathogenic Microbes

Candida albicans mannan

Leishmania donovani lipophosphoglycan

Mycobacterium tuberculosis lipoarabinomannan
MBP with Bound Oligosaccharide

PDB: 2MSB
Structure of Mannose Binding Proteins (MBPs)

Binding at Cell Surface

Trimeric CRD Cluster
Receptor Mediated Phagocytosis by Macrophages

![Diagram showing the process of receptor-mediated phagocytosis by macrophages.](image-url)
Leucocyte Interaction with Endothelial Cells

- Leucocyte in circulation
- Weak adhesion and rolling selectin-mediated
- Strong adhesion integrin-mediated
- Endothelium
- Migration through endothelium
- Tissue
Selectins and Some Glycoprotein Ligands
Structures of Lewis\textsuperscript{x} Ligands for Selectins

Sialyl-Lewis\textsuperscript{x}

\[ \text{Neu}\alpha2-3\text{Gal}\beta1 \]
\[ \text{GlcNAc}\beta1-3\text{Gal}\beta1-4\text{GlcNAc}\beta1-3\text{Gal}\beta1-4\text{GlcNAc}\beta1-6-\text{Sulphosialyl-Lewis}\textsuperscript{x} \]

Sialyl-Lewis\textsuperscript{a}

\[ \text{Fuc}\alpha1 \]
\[ \text{Neu}\alpha2-3\text{Gal}\beta1 \]
\[ \text{GlcNAc}\beta1-4\text{GlcNAc}\beta1-3\text{Gal}\beta1-4\text{GlcNAc}\beta1-6 \]

N-terminus of PSGL-1

\[ \text{GlnAlaThrGluTyrGluTyrLeuAspTyrAspPheLeuProGluThrGluProProGluMet} \]

Glycan-bearing sialyl-Lewis\textsuperscript{x} structure
Extended Binding Site in E-Selectin CRD
C-Type Lectins in Antigenic Presentation by Dendritic Cells

Potential antigen

Endocytosis and phagocytosis

Endosomal compartment

Digestion

Peptide binding to MHC

Immunological synapse formation

DC-SIGN

ICAM-3

Peptide presentation

T cell receptor
Extended Binding Sites in DC-SIGN

PDB: 1K9J

Branched Trimannose

Terminal Fucose
DC-SIGN Enhances T-Cell Infection by HIV
Organization of Sialoadhesin and Other Siglec Proteins
Sialic Acid-Containing Siglec Ligands
Overall Fold & Binding in Sialoadhesin CRD
CD22 Inhibits Reactivity with Sialic Acid-Bearing Cells
Galectin Structure & Function

- Dimeric
- Tandem repeat
- N-terminal extended

Galectins
- 1, 2, 5, 7, 10, 11, 13, and 14
- 4, 6, 8, 9 and 12
- 3

Galectin

RNP particle

Subcortical vesicles

Nucleus

Extracellular matrix
Galβ1-4GlcNAc Binding to Galectin 1

PDB: 1HLC
Structure of the Galectin Dimer with Bound Disaccarides that Bridge between Glycans

PDB: 1HLC
Cross Linking of Glycans by Galectin 3 keeps T-cell Receptor molecules spaced apart. Thus, the receptors cannot cluster as they normally would, and activation of the lymphocyte is suppressed.
Function of Galectins in Apoptosis of T-Cells

- Bone marrow
- Thymus
- Spleen and lymph node
- Skin and mucosa

- Antigen scavenging
- Dendritic cells
- Antigen processing
- Presentation

- Self recognition
- Apoptosis
- Galectins 1 & 9

- Stem cell
- T cells

- Activated T lymphocytes
- Apoptosis to end response

- Galectins 1 & 9